Standing on one shoulder

Valorisation

What is the is practical value of research? Depending on the scientific discipline this may be a tricky question to answer. Particularly because some research is focused on the development and advancement of scientific knowledge itself, without any other purpose than just that: scientific knowledge. A practical purpose may not immediately exist, or at some point it might emerge in an area that could not have been foreseen when the research was initiated.

The question about the practical value of *research on research* is even more tricky. After all, this type of research will not lead to new medicines, or to a better understanding of how cancer could be prevented. No new energy resources will be discovered because of it, and no new techniques will be developed for the removal of garbage. Employees will not collaborate more efficiently, and neither will the chances on world peace increase as a result of research on research.

At least not directly and not immediately.

So, what then is the practical value of research on research? And what is the practical value of research on citation bias and other dissemination biases? (See also Box 2 in Chapter 1.) How does this research impact society?

I believe there are roughly three aspects on which this type of research has an impact: on truth finding, on research efficiency, and on public trust.

In previous chapters, it was already shown that citation bias can lead to unfounded consensus and false beliefs (1), to polarisation between research groups (2), and to misplaced decisions about patients (3). These are clear examples in which the truth finding is in jeopardy, and how this can have societal impact. In addition, citation bias can lead to research waste (1, 4), and thus to an unnecessary rise in costs and time. Finally, the distorted information in the media (5) as well as the misplaced decisions about treatment (3) could harm the public trust in science.

Research on citation bias can help a) to discover the prevalence of citation bias, b) to identify the conditions under which it flourishes, and c) to keep its societal consequences under control.

Research efficiency

Research efficiency was investigated in the famous *Lancet*-series (6). It was estimated that 85% of all biomedical research is in fact unnecessary and a waste of resources.

This includes the impact of dissemination biases although the exact contribution of citation bias was not specified. Obviously, increasing research efficiency would reduce the financial burden on a society, and could move forward the development and availability of new medicines and guidelines for risk prevention.

Truth

I believe that the scientific method, with all its limitations and uncertainties, is a great, if not the greatest, method to develop knowledge and search for truth. I also believe that *the way the scientific method is currently being applied*, is far from ideal, and that it sometimes brings us further from the truth instead of closer by.

For the scientific method to function, we need to adhere to certain rules. For instance, we need to take all types of evidence into account. Particularly in the hypothesis-testing phase, all relevant information should be *reported* and *published* and *cited* in an unbiased manner. If negative evidence is being ignored, as discussed in Chapter 1, the scientific method can no longer function. It will lead us to wrong conclusions (1).

So, research on research can help to reveal how biases can have an impact on truth finding. Many societal aspects of Western life are influenced by scientific research, in the form of guidelines, approval of new medicines, assessment of risk factor for employees (e.g. diesel exhaust exposure) and for residents (e.g. high voltage masts). If this scientific research is biased, then the guidelines and policies will be biased as well. The societal value of research on research lies in the understanding and prevention of these biases.

Several research misbehaviours were recently evaluated in a survey among 'research on research' researchers (7). The impact on both truth finding and public trust was assessed. According to this survey, publication bias and citation bias are ranked as some of the most frequently occurring research misbehaviours. In fact, to 'selectively cite to enhance your own findings or convictions' is ranked as the first most occurring research misbehaviour, whereas 'not publish[ing] a valid negative study' ranked 3rd.

In addition, the respondents to this survey considered the impact of these misbehaviours on truth finding to be worrying. In an additional analysis the authors looked at the *aggregate* impact level, with the impact of individual misbehaviours weighted by their frequency of occurrence. The overall impact of the citation bias on truth ranked 6th (out of 60) on the aggregate level, publication bias ranked 7th, and outcome reporting bias ranked 16th.

Trust

But even if scientific research would be unbiased, and the conclusions and theories are valid and truthful, their positive impact on society will diminish if the public has lost their trust in science. The attitude towards vaccinations provide an interesting example. Many studies have shown that vaccinations do not lead to a higher risk of autism (8), mostly recently again in a study among the Danish (9). It is a clear and consistent negative finding, 'no association between vaccinations and autism', and it seems that these negative findings are reported and published in the scientific community without bias. However, the public do not trust these findings, and an increasing number of parents refuse to vaccinate their children. Ironically, they base their scepticism of vaccination on another 'scientific' publication, that turned out to be fabricated and fraudulent and that was retracted later (10). So even if science functions properly, without the public trust its positive impact on society will diminish.

In the survey mentioned above, the impact on public trust of citation bias was ranked 12th, and the impact of publication bias was ranked 11th. Inadequate archiving and collaboration were assumed to be more worrying in the public eye than these dissemination biases. Nevertheless, on the scale of 60 items, the dissemination biases still score relatively high.

The media bias in the coverage of scientific results might also contribute to the lack of public trust. Scientific findings that appear in the media are often based on individual studies. As such, they are either unrepresentatively positive, or they are representative and contradictory (11). In my opinion, neither type of coverage is good for the public trust in science. A blog by Brian Resnick adequately summarised this study as follows: "Study: half of the studies you read about in the news are wrong" (12).

If trust disappears, the result will be that scientists can lock themselves up doing research in an ivory tower, but they will lose their influence in the real world. Instead of evidence-based medicine and policies, we will sink deeper in an era of fake news in which every opinion is equal. Even if truth goes unharmed, the impact of truth will diminish, and the result will be the same: a fact-free world full in which twitter opinions end up on equal footing as scientific findings. Research on research is a small but crucial element in preventing this from happening.

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